



Integrated Solar Combined Cycle of Kuraymat

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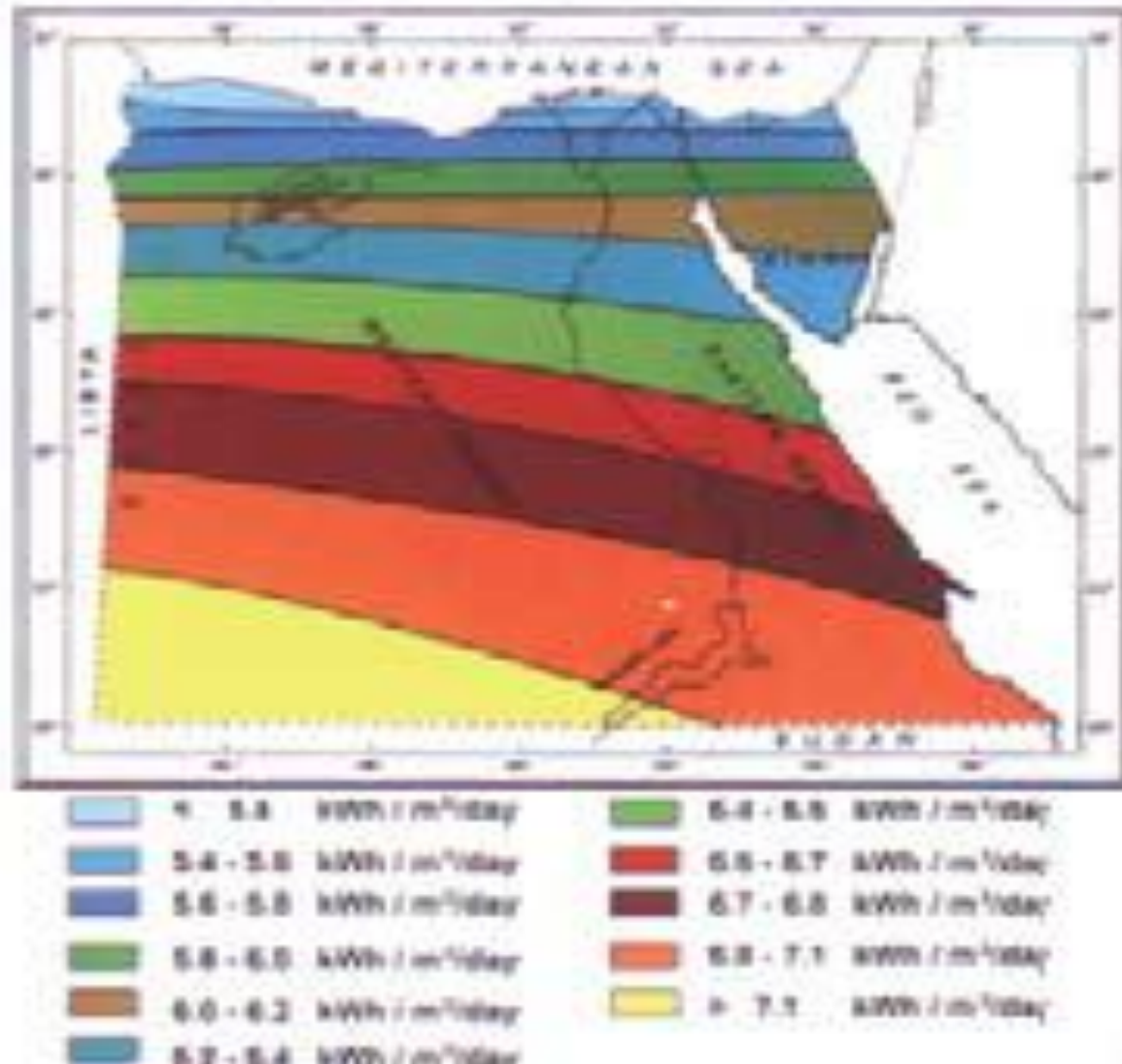
Introduction:

Resource Assessment :

- Egypt is one of the countries that are located in “sunbelt” area and most suitable for solar energy applications.
- The solar Atlas was issued in 1991, the results of Atlas shows that the average direct normal solar radiation is 2000 – 3200 kWh/m²/year.
- The sunshine duration ranges between 9 – 11 h/day from North to South with very few cloudy days.

Solar Resource Assessment:

Egypt Annual Average of Direct Solar Radiation



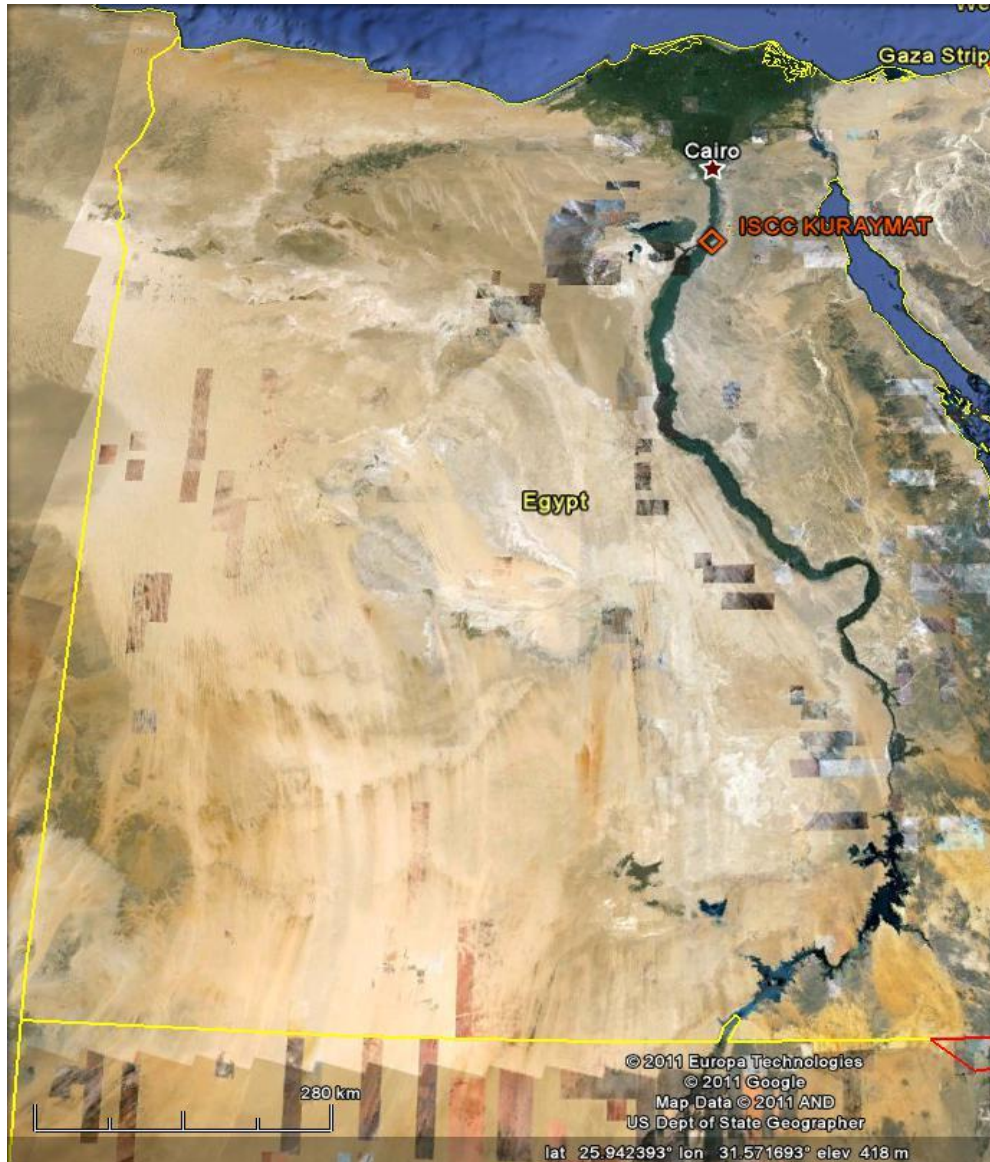


The Project Location:

The project site at Kuraymat, which locates nearly 90 km South Cairo, has been selected because it is:

- High intensity direct solar radiation reaches to 2400 kWh /m² / year.
- An extended unified power grid and expanded natural gas pipelines.
- Located near to the sources of water (the River Nile).
- An uninhabited flat desert land.

Location of the project



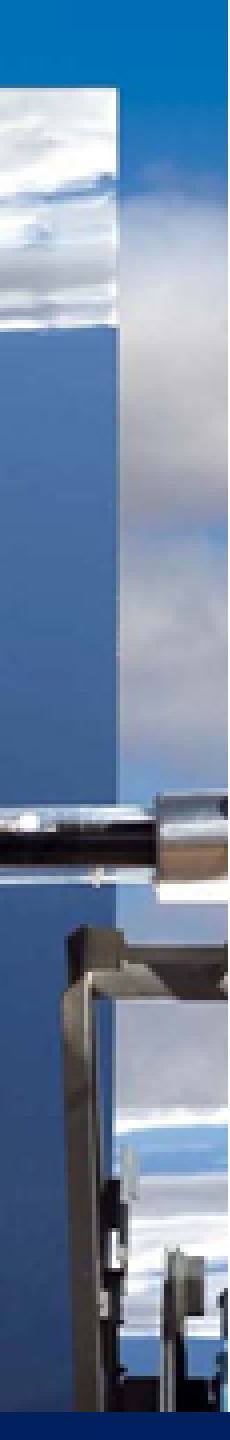
Location: Kuraymat, Egypt

Longitude:
31,25 ° E

Latitude:
29,27 ° N

Altitude:
60 m

Annual Direct Normal
Irradiation:
2.431 kWh/m²

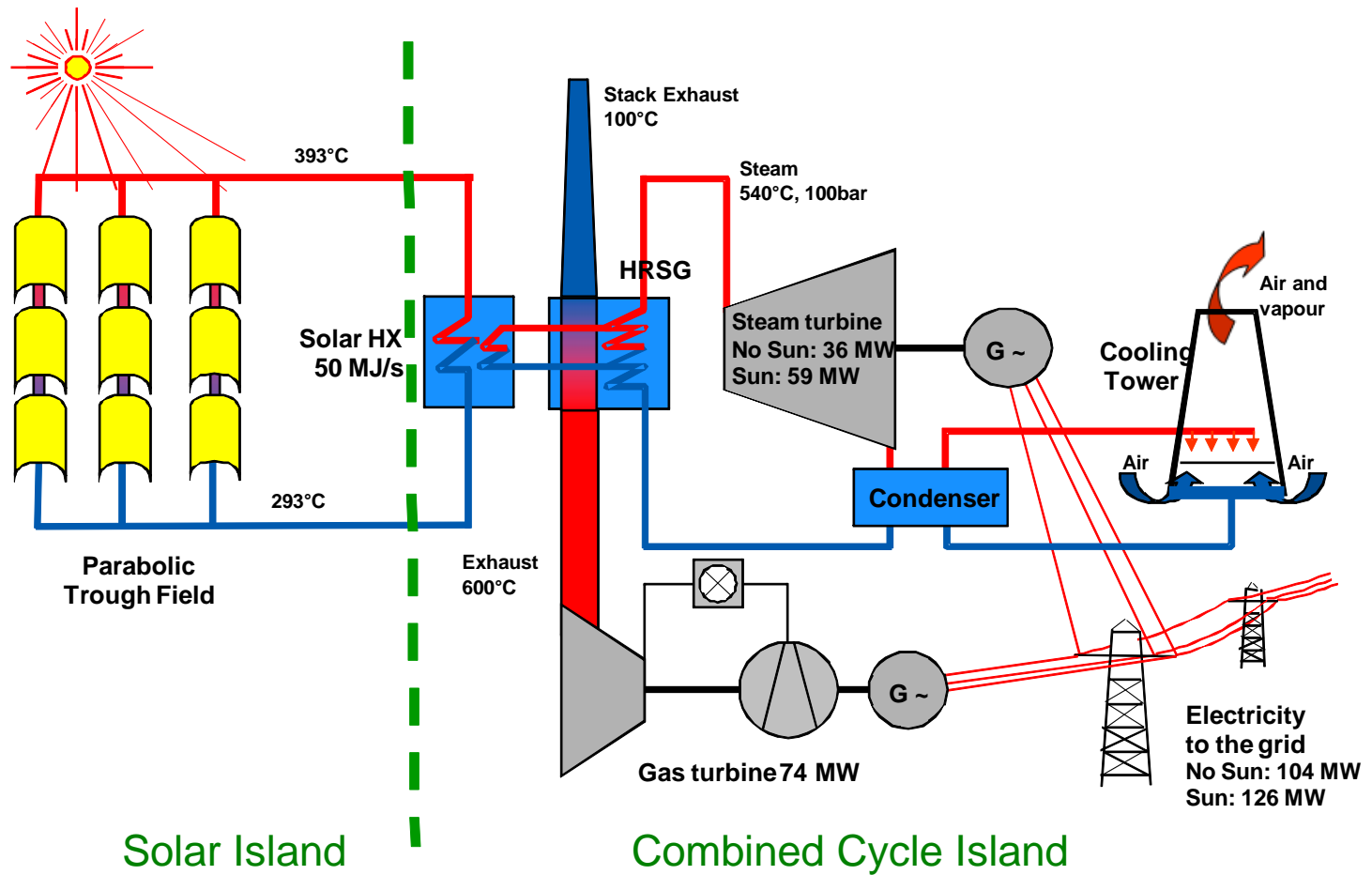
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- The project based on parabolic trough technology integrated with combined cycle power plant using natural gas as a fuel.
 - The project is one of 3 similar projects are being implemented in Africa (Morocco, Algeria, Egypt), which mainly depending on integrating solar field with combined cycle.
 - The capacity of the project is 140 MW including solar share of 20 MW. Total cost is 340 Million US Dollar.
 - The project was completed and put in commercial operation on June 29th, 2011.



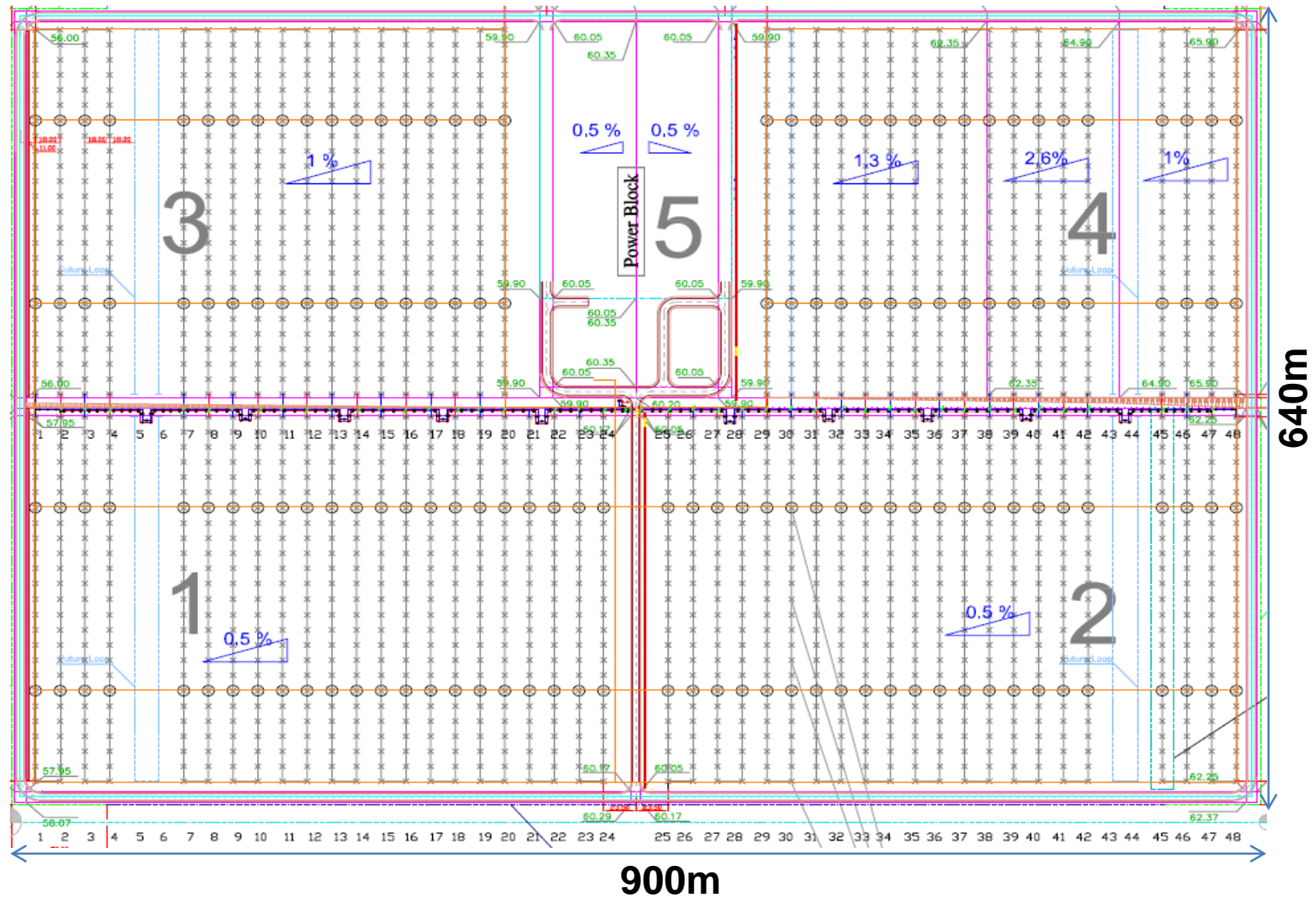
Finance Resources of ISCC:

- 50 Million dollar grant from global environmental facility (GEF) – World Bank.
- 190 Million US Dollar soft loan from Japanese International co-operation Agency (JICA) (0,75% interest – 40 years repayment period including 10 years grace period).
- 100 Million US Dollar provided by NREA.

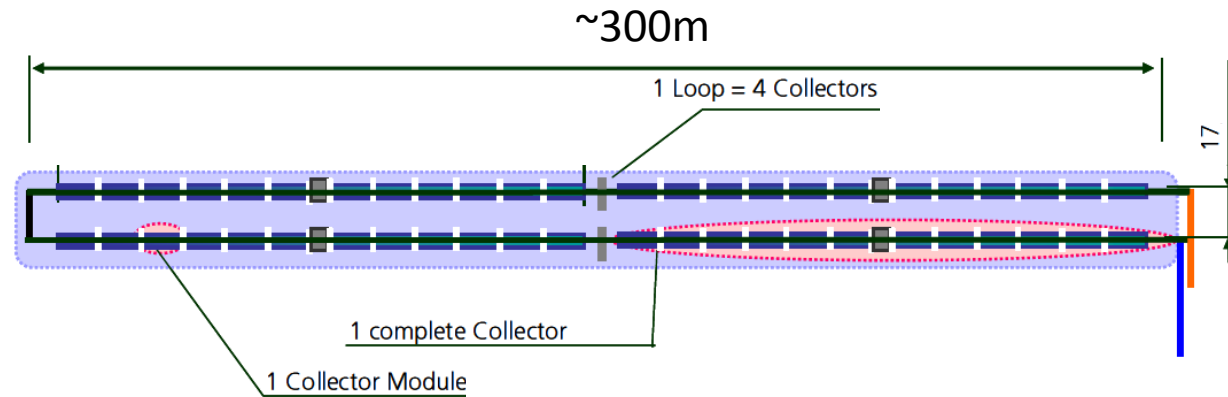
Technical Concept



General Layout of Solar Island

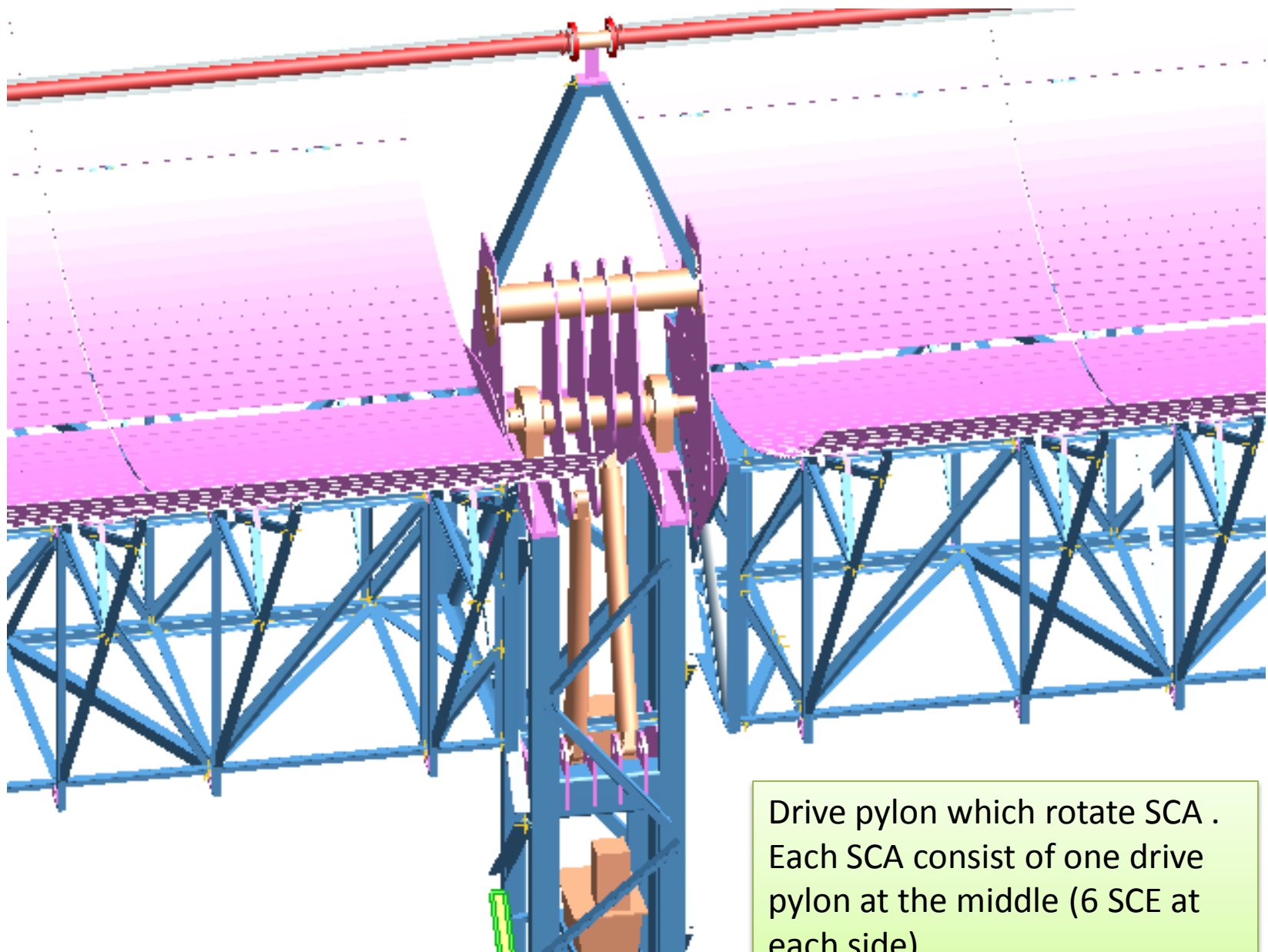


Solar Collector Loop



Car conveying SCE from the
assembly hall to the field

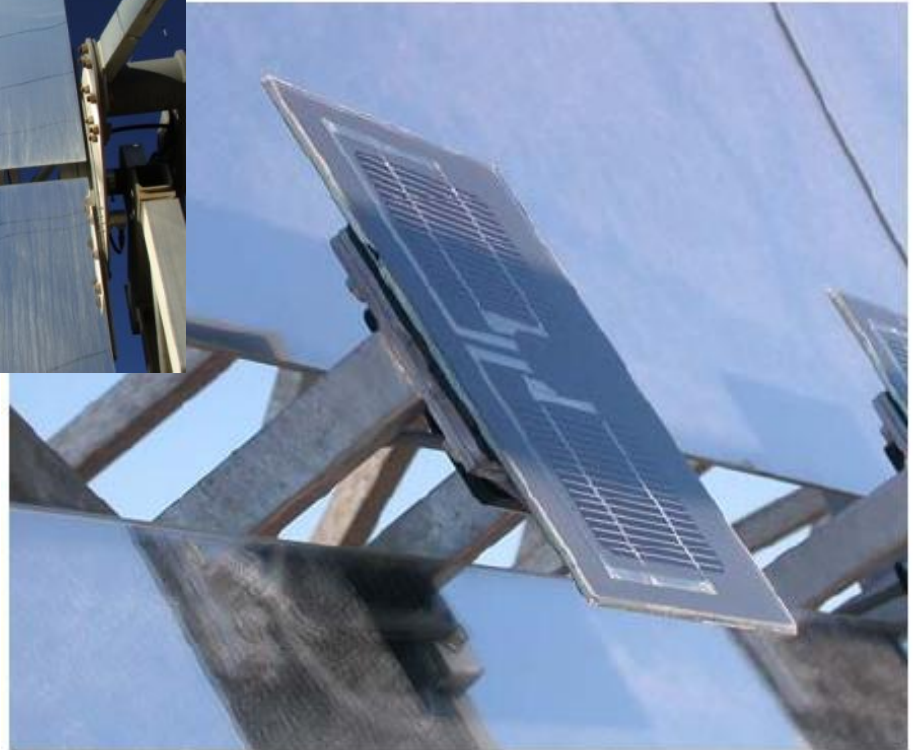




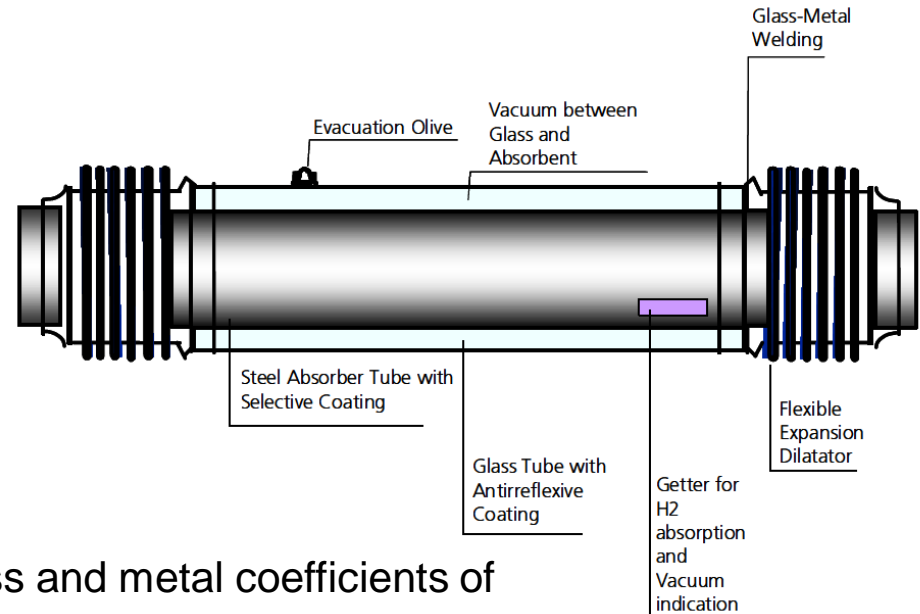
Drive pylon which rotate SCA .
Each SCA consist of one drive
pylon at the middle (6 SCE at
each side)

Sun tracking of the Solar Collectors by a sensor

Photovoltaic cell causing two currents



Absorber Tube Schott PTR 70



- Improved reliability
- Improved match between glass and metal coefficients of thermal expansion
- 100% testing of glass-to-metal seal
- Improved performance
- New bellows configuration that compresses when tube is hot
- Improved getter mounting to keep getters cool to increase hydrogen absorption capacity
- More durable anti-reflective coating on glass
- Reduced hydrogen permeation
- Selective coating



Technical data of Solar Island

Description	Value	Unit
Number of Completed Collector Loops	40	-
Number of Completed Collectors per Loop	4	-
Number of Completed Collectors	160	-
Number of Collectors Modules per Completed Collectors	12	-
Number of the whole Collectors Modules	1920	-
Total Effective Mirror Area appr.	131.000	m ²
HTF Loop Inlet Temperature	293	°C
HTF Loop Outlet Temperature	393	°C
Maximum Solar Field Thermal Energy Output	61	MW _t





Irradiation Measurement





The Contractor supplied 2 washing trucks. 20 Loops can be cleaned everyday that means the solar field is completely cleaned every two day. Rate of consumable water is 30 M³/day.

2009/12/03 10

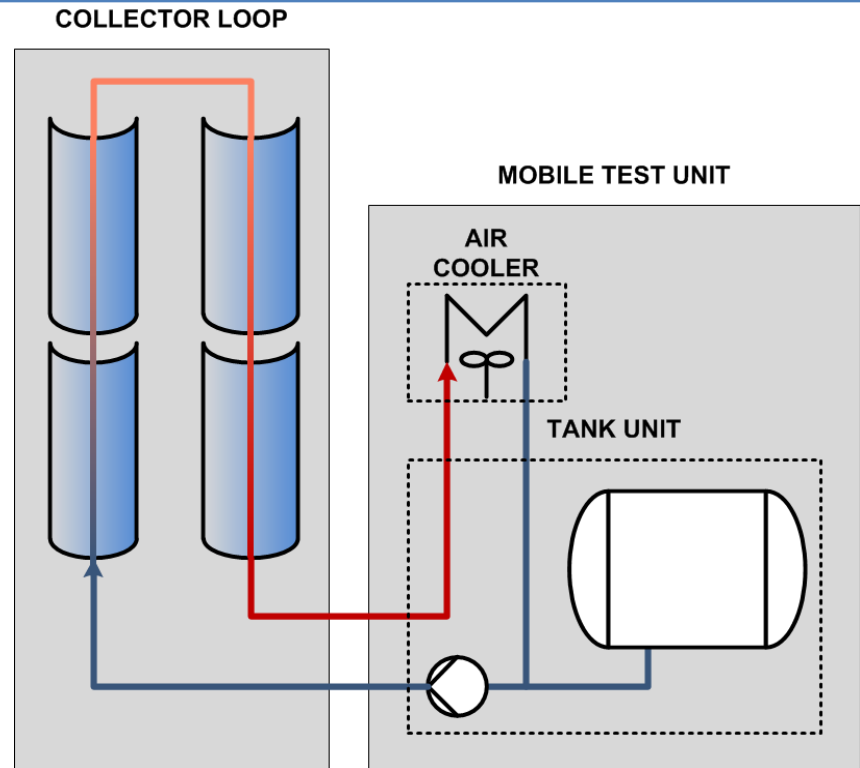
Solar Field Performance Test

Mobile Test Unit

Mobile Test Unit (MTU)

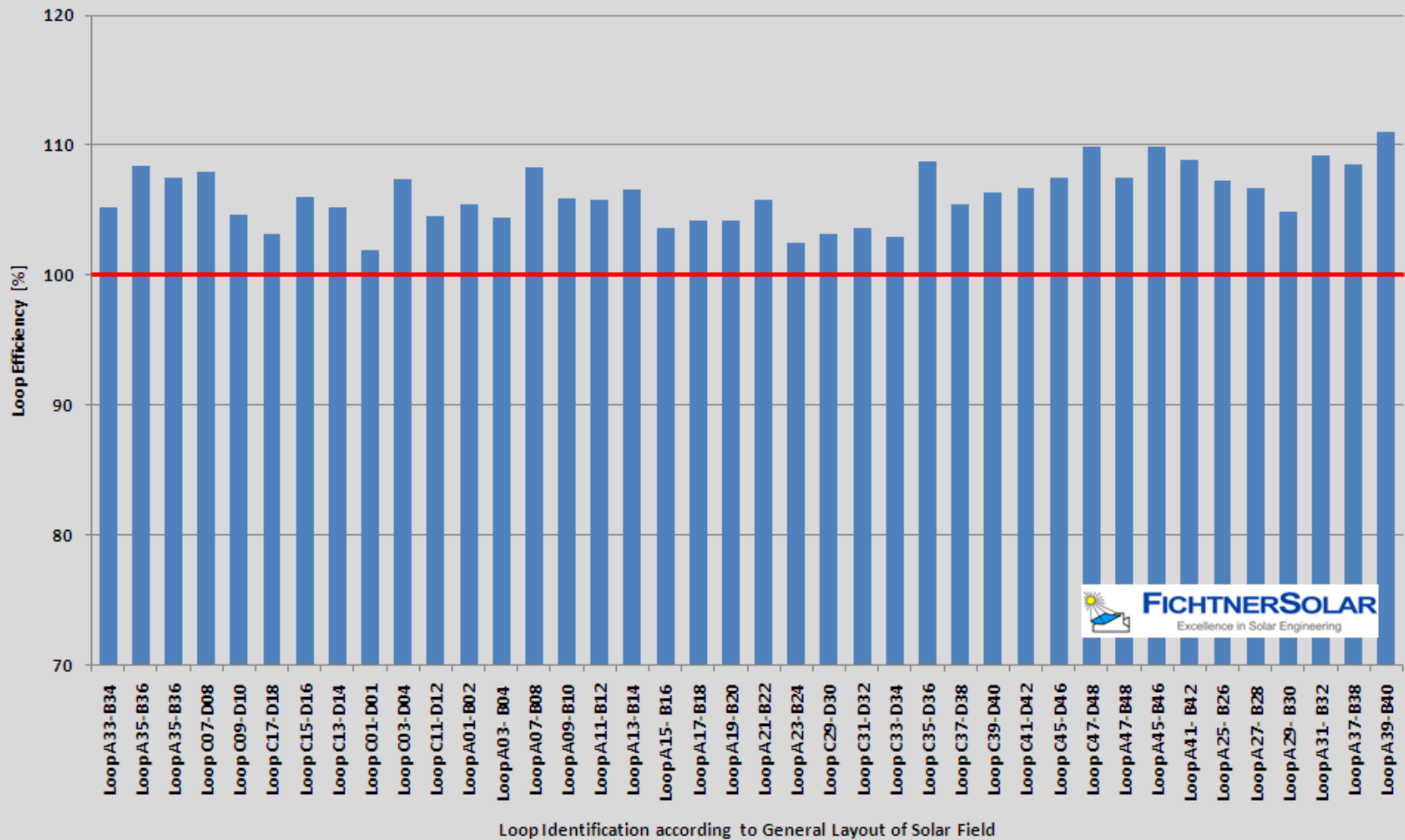
- **Working principle**
 - Circulation of HTF between MTU and collector loop
 - HTF is heated up during passage through collector loop
 - Hot HTF is cooled down in MTU air cooler (heat exchanger)
 - Compensation of volumetric expansion of HTF via expansion vessel

Simplified Process Flow Diagram of Performance Test





Loop Efficiency based on Loop-by-Loop Thermal Performance Test



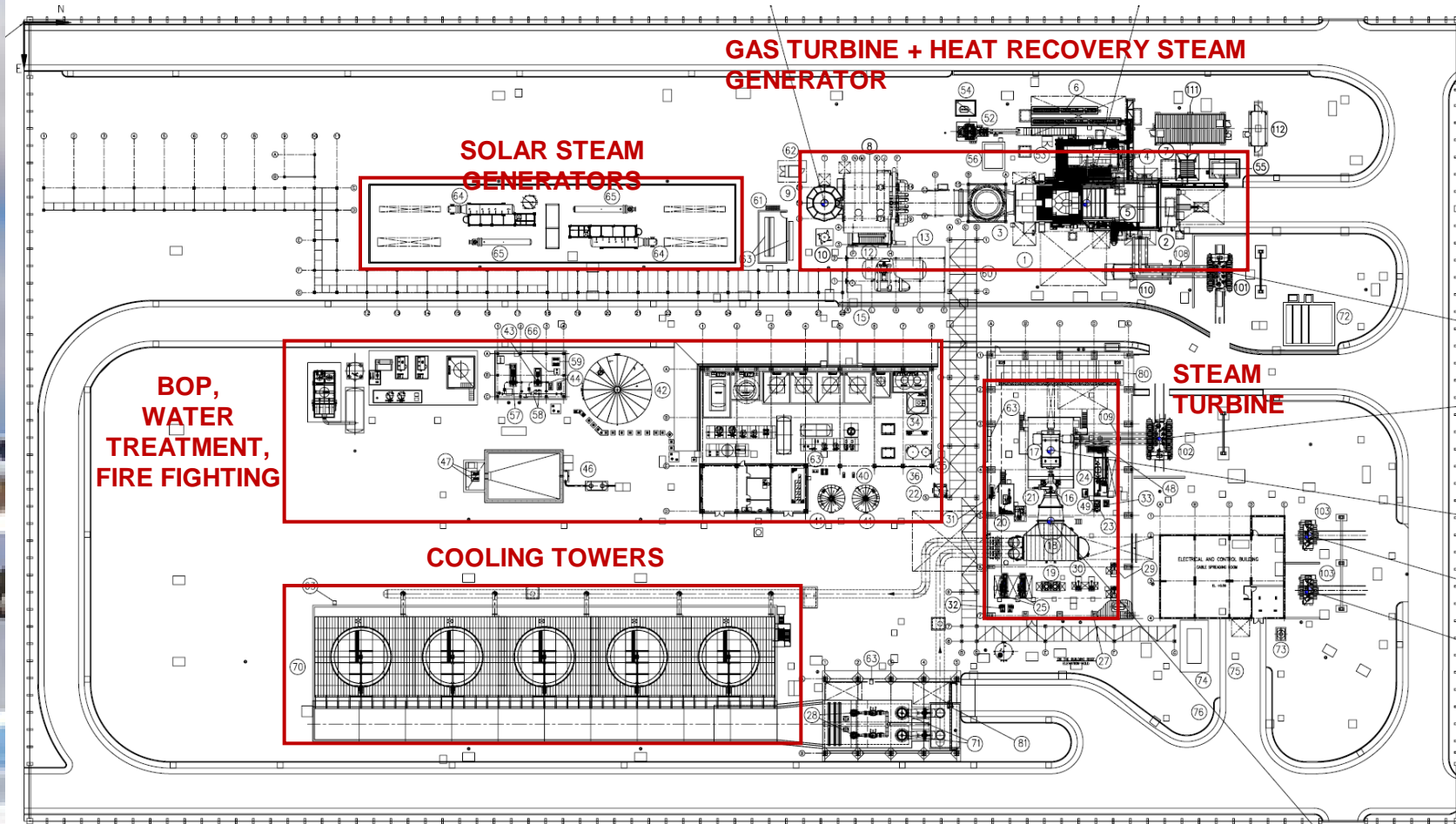


Technical data of Combined Cycle

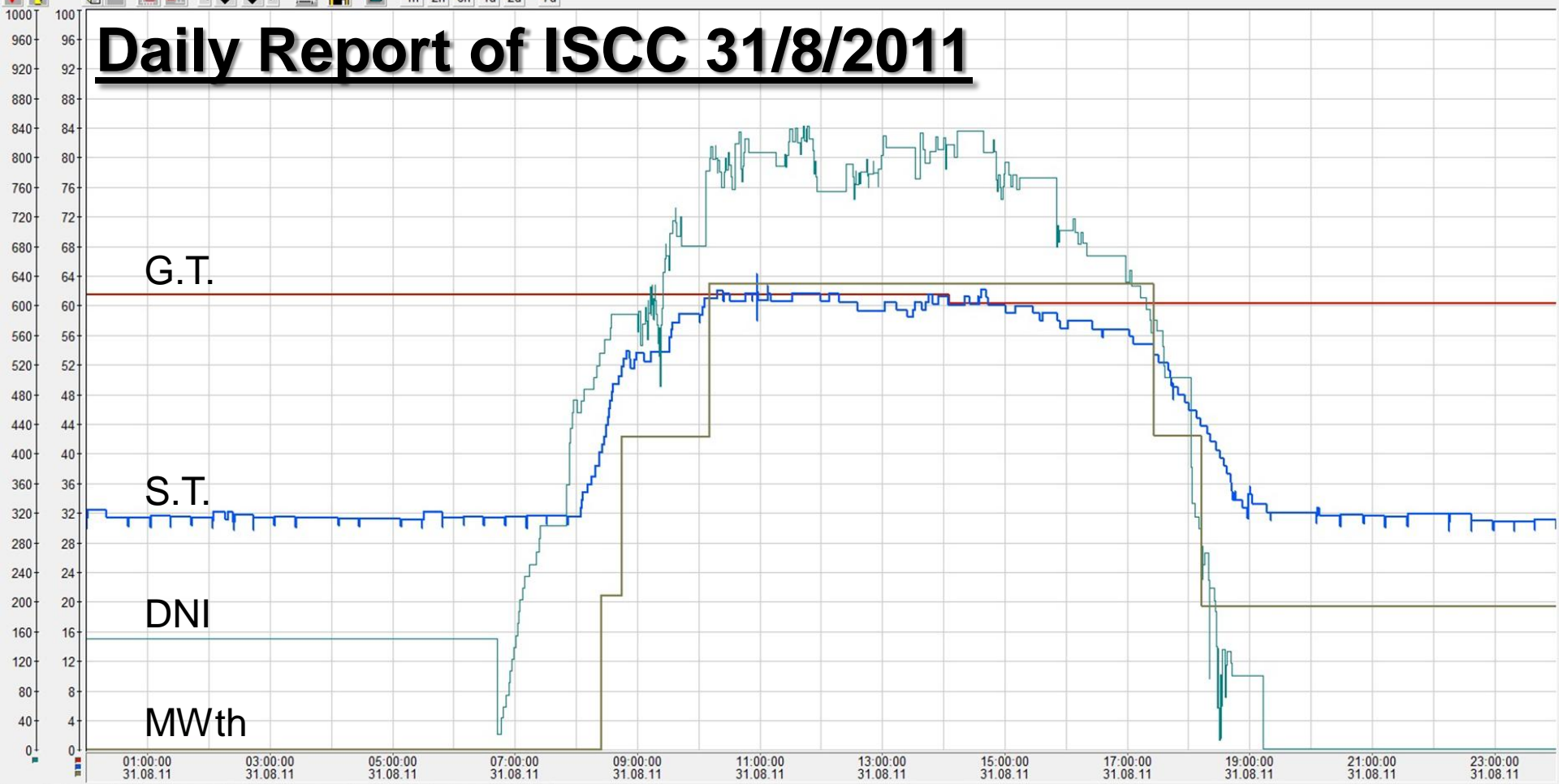
Item	Description
Gas Turbine	<ul style="list-style-type: none">• General Electric Type PG 6111 FA• 74 MW at 20°C ambient temperature
Steam Turbine	<ul style="list-style-type: none">• Siemens SST 900• 60 MW @ 50 MJ/s Solar Heat Input• 36 MW without Solar Heat Input
Heat Recovery Steam Generator and Solar Heat Exchangers	Steam generation by Solar Heat Exchangers (Pre-heater + Evaporator) and feeding into high pressure steam drum
Cooling Towers	Evaporative cooling with make-up water from Nile

Technical data

Combined Cycle General



Daily Report of ISCC 31/8/2011



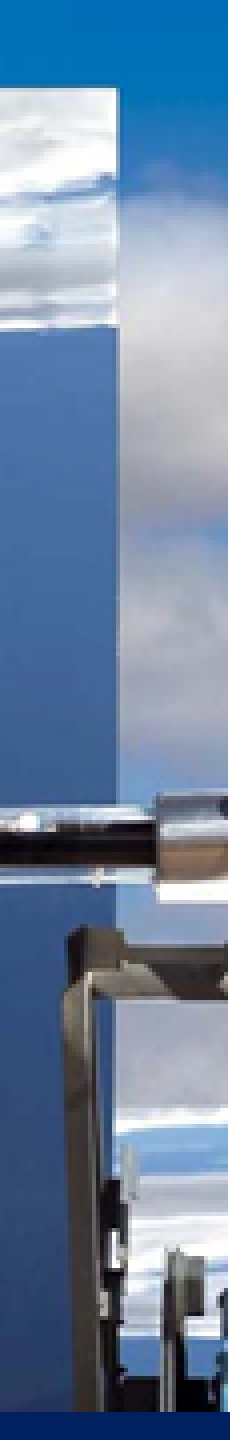
color ** flip all delete set MRB set MRE toggle flood move to top set specific attributes

Signal	No	Current Value	Y-MRB	Y-MRE	MRB KKS	MRE KKS	Dim	description (longtext)	DB-CalcFunc	ValueTransform	Scanner	Driver
01MBA01CUST_DWAT	1	60.30	0.0	100.0	-11	110	MW	U1 GT load	-/-	-/-	800M-SRV1	OPC
02MKA01CE074XE01	2	29.73	0.0	100.0	0	100	MW	Active power	-/-	-/-	800M-SRV1	OPC
11WBG01CX002WE01	3	2.58	0	1000.0	0	1500	W/m2	Meteorological Data 1 - DNI	-/-	-/-	800M-SRV1	OPC
TERMPWRHTF	4	19.44	0.0	100.0	-20	2000	MWth	Thermal Power in HTF	-/-	-/-	800M-SRV1	OPC

Time Scheduler

from 31.08.11 00:00:00.000 up to 01.09.11 00:00:00.000

Ok



Technical Data of The Integrated Solar Combined Cycle in Kuraymat Site:

Total Capacity Power in MW:	140
Capacity of Solar Portion in MW:	20
Net Electric Energy in GWh/a:	852
Solar Electric Energy in GWh/a:	34
Fuel Saving Due to The Solar Portion T.O.E/a:	10000
Co2 Reduction T/a:	20000

Thanks for Your Attention